

SEQUENCE LISTING

<110> National Research Council of Canada

<120> Overexpression in Yeast and Plants of a Gene Encoding
Glycerol 3-Phosphate Acyltransferase

<130> 44838-PT

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<150> US 60/139788

<151> 1999-06-21

<150> US 60/182905

<151> 2000-02-16

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<170> PatentIn Ver. 2.1

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<211> 1671

<212> DNA

<213> *Carthamus tinctorius*

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<213> *Carthamus tinctorius*

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<212> PRT

<213> Carthamus tinctorius

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Ser Pro Ser Ser Ser Pro Ser Ser Ala Phe Thr Pro Pro Leu Ser Ser
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Ser Arg Leu Arg Pro Ile Leu Arg Gly Phe Pro Cys Leu Ala Phe Ser
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Ala Pro Ala Asn Ala Ala His Gly Thr Ala Glu Thr Val His Gly Asn
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Lys Trp Pro Ser Pro Ser Ser Ser Ser Ala Ala Thr Gln Pro Ser
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Ala Gly Ser Asp His Gly His Ser Arg Thr Phe Ile Asp Ala Arg Ser
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Glu Gln Asp Leu Leu Ser Gly Ile Gln Arg Glu Leu Glu Ala Gly Thr
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Leu Pro Lys His Ile Ala Gln Ala Met Glu Glu Leu Tyr Gln Asn Tyr
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Lys Asn Ala Val Leu Gln Ser Ala Ala Pro His Ala Glu Asp Ile Val
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Leu Ser Asn Met Arg Val Ala Phe Asp Arg Met Phe Leu Asp Val Lys
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Glu Pro Phe Glu Phe Ser Pro Tyr His Glu Ala Ile Leu Glu Pro Phe
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Asn Tyr Tyr Met Phe Gly Gln Asn Tyr Ile Arg Pro Leu Val Asn Phe
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Arg Glu Ser Tyr Val Gly Asn Val Ser Val Phe Gly Val Met Glu Glu
 225 230 235 240

Gln Leu Lys Gln Gly Asp Asn Val Val Leu Ile Ser Asn His Gln Thr
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Glu Ala Asp Pro Ala Val Ile Ala Leu Met Leu Glu Thr Thr Asn Pro
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His Ile Ser Glu Asn Ile Ile Tyr Val Ala Gly Asp Arg Val Ile Thr
 275 280 285

Asp Pro Leu Cys Lys Pro Phe Ser Met Gly Arg Asn Leu Leu Cys Val
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Tyr Ser Lys Lys His Met Asn Asp Val Pro Glu Leu Ala Glu Met Lys
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Ser Leu Asp Asn Met Arg Arg Leu Val Asp His Ala Gly Leu Val Gly
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His Ile Tyr Pro Leu Ala Ile Leu Cys His Asp Ile Met Pro Pro Pro
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Asn Ala Val Leu Gln Ser Ala Ala Pro His Ala Glu Asp Ile Val Leu
 50 55 60

Ser Asn Met Arg Val Ala Phe Asp Arg Met Phe Leu Asp Val Lys Glu
 65 70 75 80

Pro Phe Glu Phe Ser Pro Tyr His Glu Ala Ile Leu Glu Pro Phe Asn
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Tyr Tyr Met Phe Gly Gln Asn Tyr Ile Arg Pro Leu Val Asn Phe Arg
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Glu Ser Tyr Val Gly Asn Val Ser Val Phe Gly Val Met Glu Glu Gln
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Leu Lys Gln Gly Asp Lys Val Val Leu Ile Ser Asn His Gln Thr Glu
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Ala Asp Pro Ala Val Ile Ala Leu Met Leu Glu Thr Thr Asn Pro His
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Ile Ser Glu Asn Ile Ile Tyr Val Ala Gly Asp Arg Val Ile Thr Asp
 165 170 175

Pro Leu Cys Lys Pro Phe Ser Met Gly Arg Asn Leu Leu Cys Val Tyr
 180 185 190

Ser Lys Lys His Met Asn Asp Val Pro Glu Leu Ala Glu Met Lys Lys
 195 200 205

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Arg Ser Asn Thr Arg Ser Leu Lys Glu Met Ala Leu Leu Leu Arg Gly
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Gly Ser Lys Ile Ile Trp Ile Ala Pro Ser Gly Gly Arg Asp Arg Pro
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Asp Pro Ile Thr Asn Gln Trp Phe Pro Ala Pro Phe Asp Ala Thr Ser
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Leu Asp Asn Met Arg Arg Leu Val Asp His Ala Gly Leu Val Gly His
 260 265 270

Ile Tyr Pro Leu Ala Ile Leu Cys His Asp Ile Met Pro Pro Pro Leu
 275 280 285

Gln Val Glu Lys Glu Ile Gly Glu Lys Arg Leu Ile Ser Phe His Gly
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Thr Gly Ile Ser Val Ala Pro Glu Ile Asn Phe Gln Glu Val Thr Ala
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Ser Cys Gly Ser Pro Glu Glu Ala Lys Ala Ala Tyr Ser Gln Ala Leu
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Tyr Asp Ser Val Cys Glu Gln Tyr Lys Val Leu His Ser Ala Val His
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Pro Leu Gln Phe Leu Asp
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<213> Carthamus tinctorius

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Asn Ala Val Leu Gln Ser Ala Ala Pro His Ala Glu Asp Ile Val Leu
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Ser Asn Met Arg Val Ala Phe Asp Arg Met Phe Leu Asp Val Lys Glu
 65 70 75 80

Pro Phe Glu Phe Ser Pro Tyr His Glu Ala Ile Leu Glu Pro Phe Asn
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Tyr Tyr Met Phe Gly Gln Asn Tyr Ile Arg Pro Leu Val Asn Phe Arg
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Glu Ser Tyr Val Gly Asn Val Ser Val Phe Gly Val Met Glu Glu Gln
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Leu Lys Gln Gly Asp Lys Val Val Leu Ile Ser Asn His Gln Thr Glu
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Pro Leu Cys Lys Pro Phe Ser Met Gly Arg Asn Leu Leu Cys Val Tyr
 180 185 190

Ser Lys Lys His Met Asn Asp Val Pro Glu Leu Ala Glu Met Lys Lys
 195 200 205

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 225 230 235 240

Asp Pro Ile Thr Asn Gln Trp Phe Pro Ala Pro Phe Asp Ala Thr Ser
 245 250 255

Leu Asp Asn Met Arg Arg Leu Val Asp His Ala Gly Leu Val Gly His
 260 265 270

Ile Tyr Pro Leu Ala Ile Leu Cys His Asp Ile Met Pro Pro Pro Leu
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Gln Val Glu Lys Glu Ile Gly Glu Lys Arg Leu Ile Ser Phe His Gly
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<213> Escherichia coli

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<400> 9

Met Thr Phe Cys Tyr Pro Cys Arg Ala Phe Ala Leu Leu Thr Arg Gly
 1 5 10 15

Phe Thr Ser Phe Met Ser Gly Trp Pro Arg Ile Tyr Tyr Lys Leu Leu
 20 25 30

Asn Leu Pro Leu Ser Ile Leu Val Lys Ser Lys Ser Ile Pro Ala Asp
 35 40 45

Pro Ala Pro Glu Leu Gly Leu Asp Thr Ser Arg Pro Ile Met Tyr Val
 50 55 60

Leu Pro Tyr Asn Ser Lys Ala Asp Leu Leu Thr Leu Arg Ala Gln Cys
 65 70 75 80

Leu Ala His Asp Leu Pro Asp Pro Leu Glu Pro Leu Glu Ile Asp Gly
 85 90 95

Thr Leu Leu Pro Arg Tyr Val Phe Ile His Gly Gly Pro Arg Val Phe
 100 105 110

Thr Tyr Tyr Thr Pro Lys Glu Glu Ser Ile Lys Leu Phe His Asp Tyr
 115 120 125

Leu Asp Leu His Arg Ser Asn Pro Asn Leu Asp Val Gln Met Val Pro
 130 135 140

Val Ser Val Met Phe Gly Arg Ala Pro Gly Arg Glu Lys Gly Glu Val
 145 150 155 160

Asn Pro Pro Leu Arg Met Leu Asn Gly Val Gln Lys Phe Phe Ala Val
 165 170 175

Leu Trp Leu Gly Arg Asp Ser Phe Val Arg Phe Ser Pro Ser Val Ser
 180 185 190

Leu Arg Arg Met Ala Asp Glu His Gly Thr Asp Lys Thr Ile Ala Gln
 195 200 205

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Lys Leu Ala Arg Val Ala Arg Met His Phe Ala Arg Gln Arg Leu Ala
 210 215 220

Ala Val Gly Pro Arg Leu Pro Ala Arg Gln Asp Leu Phe Asn Lys Leu
 225 230 235 240

Leu Ala Ser Arg Ala Ile Ala Lys Ala Val Glu Asp Glu Ala Arg Ser
 245 250 255

Lys Lys Ile Ser His Glu Lys Ala Gln Gln Asn Ala Ile Ala Leu Met
 260 265 270

Glu Glu Ile Ala Ala Asn Phe Ser Tyr Glu Met Ile Arg Leu Thr Asp
 275 280 285

Arg Ile Leu Gly Phe Thr Trp Asn Arg Leu Tyr Gln Gly Ile Asn Val
 290 295 300

His Asn Ala Glu Arg Val Arg Gln Leu Ala His Asp Gly His Glu Leu
 305 310 315 320

Val Tyr Val Pro Cys His Arg Ser His Met Asp Tyr Leu Leu Leu Ser
 325 330 335

Tyr Val Leu Tyr His Gln Gly Leu Val Pro Pro His Ile Ala Ala Gly
 340 345 350

Ile Asn Leu Asn Phe Trp Pro Ala Gly Pro Ile Phe Arg Arg Leu Gly
 355 360 365

Ala Phe Phe Ile Arg Arg Thr Phe Lys Gly Asn Lys Leu Tyr Ser Thr
 370 375 380

Val Phe Arg Glu Tyr Leu Gly Glu Leu Phe Ser Arg Gly Tyr Ser Val
 385 390 395 400

Glu Tyr Phe Val Glu Gly Gly Arg Ser Arg Thr Gly Arg Leu Leu Asp
 405 410 415

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Pro Lys Thr Gly Thr Leu Ser Met Thr Ile Gln Ala Met Leu Arg Gly
 420 425 430

Gly Thr Arg Pro Ile Thr Leu Ile Pro Ile Tyr Ile Gly Tyr Glu His
 435 440 445

Val Met Glu Val Gly Thr Tyr Ala Lys Glu Leu Arg Gly Ala Thr Lys
 450 455 460

Glu Lys Glu Ser Leu Pro Gln Met Leu Arg Gly Leu Ser Lys Leu Arg
 465 470 475 480

Asn Leu Gly Gln Gly Tyr Val Asn Phe Gly Glu Pro Met Pro Leu Met
 485 490 495

Thr Tyr Leu Asn Gln His Val Pro Asp Trp Arg Glu Ser Ile Asp Pro
 500 505 510

Ile Glu Ala Val Arg Pro Ala Trp Leu Thr Pro Thr Val Asn Asn Ile
 515 520 525

Ala Ala Asp Leu Met Val Arg Ile Asn Asn Ala Gly Ala Ala Asn Ala
 530 535 540

Met Asn Leu Cys Cys Thr Ala Leu Leu Ala Ser Arg Gln Arg Ser Leu
 545 550 555 560

Thr Arg Glu Gln Leu Thr Glu Gln Leu Asn Cys Tyr Leu Asp Leu Met
 565 570 575

Arg Asn Val Pro Tyr Ser Thr Asp Ser Thr Val Pro Ser Ala Ser Ala
 580 585 590

Ser Glu Leu Ile Asp His Ala Leu Gln Met Asn Lys Phe Glu Val Glu
 595 600 605

Lys Asp Thr Ile Gly Asp Ile Ile Ile Leu Pro Arg Glu Gln Ala Val
 610 615 620

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Leu Met Thr Tyr Tyr Arg Asn Asn Ile Ala His Met Leu Val Leu Pro
 625 630 635 640

Ser Leu Met Ala Thr Ile Val Thr Gln His Arg His Ile Ser Arg Asp
 645 650 655

Val Leu Met Glu His Val Asn Val Leu Tyr Pro Met Leu Lys Ala Glu
 660 665 670

Leu Phe Leu Arg Trp Asp Arg Asp Glu Leu Pro Asp Val Ile Asp Ala
 675 680 685

Leu Ala Asn Glu Met Gln Arg Gln Gly Leu Ile Thr Leu Gln Asp Asp
 690 695 700

Glu Leu His Ile Asn Pro Ala His Ser Arg Thr Leu Gln Leu Leu Ala
 705 710 715 720

Ala Gly Ala Arg Glu Thr Leu Gln Arg Tyr Ala Ile Thr Phe Trp Leu
 725 730 735

Leu Ser Ala Asn Pro Ser Ile Asn Arg Gly Thr Leu Glu Lys Glu Ser
 740 745 750

Arg Thr Val Ala Gln Arg Leu Ser Val Leu His Gly Ile Asn Ala Pro
 755 760 765

Glu Phe Phe Asp Lys Ala Val Phe Ser Ser Leu Val Leu Thr Leu Arg
 770 775 780

Asp Glu Gly Tyr Ile Ser Asp Ser Gly Asp Ala Glu Pro Ala Glu Thr
 785 790 795 800

Met Lys Val Tyr Gln Leu Leu Ala Glu Leu Ile Thr Ser Asp Val Arg
 805 810 815

Leu Thr Ile Glu Ser Ala Thr Gln Gly Glu Gly
 820 825

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<210> 10

<211> 827

<212> PRT

<213> Escherichia coli

<400> 10

Met Thr Phe Cys Tyr Pro Cys Arg Ala Phe Ala Leu Leu Thr Arg Gly
 1 5 10 15

Phe Thr Ser Phe Met Ser Gly Trp Pro Arg Ile Tyr Tyr Lys Leu Leu
 20 25 30

Asn Leu Pro Leu Ser Ile Leu Val Lys Ser Lys Ser Ile Pro Ala Asp
 35 40 45

Pro Ala Pro Glu Leu Gly Leu Asp Thr Ser Arg Pro Ile Met Tyr Val
 50 55 60

Leu Pro Tyr Asn Ser Lys Ala Asp Leu Leu Thr Leu Arg Ala Gln Cys
 65 70 75 80

Leu Ala His Asp Leu Pro Asp Pro Leu Glu Pro Leu Glu Ile Asp Gly
 85 90 95

Thr Leu Leu Pro Arg Tyr Val Phe Ile His Gly Gly Pro Arg Val Phe
 100 105 110

Thr Tyr Tyr Thr Pro Lys Glu Glu Ser Ile Lys Leu Phe His Asp Tyr
 115 120 125

Leu Asp Leu His Arg Ser Asn Pro Asn Leu Asp Val Gln Met Val Pro
 130 135 140

Val Ser Val Met Phe Gly Arg Ala Pro Gly Arg Glu Lys Gly Glu Val
 145 150 155 160

Asn Pro Pro Leu Arg Met Leu Asn Gly Val Gln Lys Phe Phe Ala Val
 165 170 175

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Leu Trp Leu Gly Arg Asp Ser Phe Val Arg Phe Ser Pro Ser Val Ser
 180 185 190

Leu Arg Arg Met Ala Asp Glu His Gly Thr Asp Lys Thr Ile Ala Gln
 195 200 205

Lys Leu Ala Arg Val Ala Arg Met His Phe Ala Arg Gln Arg Leu Ala
 210 215 220

Ala Val Gly Pro Arg Leu Pro Ala Arg Gln Asp Leu Phe Asn Lys Leu
 225 230 235 240

Leu Ala Ser Arg Ala Ile Ala Lys Ala Val Glu Asp Glu Ala Arg Ser
 245 250 255

Lys Lys Ile Ser His Glu Lys Ala Gln Gln Asn Ala Ile Ala Leu Met
 260 265 270

Glu Glu Ile Ala Ala Asn Phe Ser Tyr Glu Met Ile Arg Leu Thr Asp
 275 280 285

Arg Ile Leu Gly Phe Thr Trp Asn Arg Leu Tyr Gln Gly Ile Asn Val
 290 295 300

His Asn Ala Glu Arg Val Arg Gln Leu Ala His Asp Gly His Glu Leu
 305 310 315 320

Val Tyr Val Pro Cys His Arg Ser His Met Asp Tyr Leu Leu Leu Ser
 325 330 335

Tyr Val Leu Tyr His Gln Gly Leu Val Pro Pro His Ile Ala Ala Gly
 340 345 350

Ile Asn Leu Asn Phe Trp Pro Ala Gly Pro Ile Phe Arg Arg Leu Gly
 355 360 365

Ala Phe Phe Ile Arg Arg Thr Phe Lys Gly Asn Lys Leu Tyr Ser Thr
 370 375 380

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Val Phe Arg Glu Tyr Leu Gly Glu Leu Phe Ser Arg Gly Tyr Ser Val
 385 390 395 400

Glu Tyr Phe Val Glu Gly Gly Arg Ser Arg Thr Gly Arg Leu Leu Asp
 405 410 415

Pro Lys Thr Gly Thr Leu Ser Met Thr Ile Gln Ala Met Leu Arg Gly
 420 425 430

Gly Thr Arg Pro Ile Thr Leu Ile Pro Ile Tyr Ile Gly Tyr Glu His
 435 440 445

Val Met Glu Val Gly Thr Tyr Ala Lys Glu Leu Arg Gly Ala Thr Lys
 450 455 460

Glu Lys Glu Ser Leu Pro Gln Met Leu Arg Gly Leu Ser Lys Leu Arg
 465 470 475 480

Asn Leu Gly Gln Gly Tyr Val Asn Phe Gly Glu Pro Met Pro Leu Met
 485 490 495

Thr Tyr Leu Asn Gln His Val Pro Asp Trp Arg Glu Ser Ile Asp Pro
 500 505 510

Ile Glu Ala Val Arg Pro Ala Trp Leu Thr Pro Thr Val Asn Asn Ile
 515 520 525

Ala Ala Asp Leu Met Val Arg Ile Asn Asn Ala Gly Ala Ala Asn Ala
 530 535 540

Met Asn Leu Cys Cys Thr Ala Leu Leu Ala Ser Arg Gln Arg Ser Leu
 545 550 555 560

Thr Arg Glu Gln Leu Thr Glu Gln Leu Asn Cys Tyr Leu Asp Leu Met
 565 570 575

Arg Asn Val Pro Tyr Ser Thr Asp Ser Thr Val Pro Ser Ala Ser Ala
 580 585 590

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Ser Glu Leu Ile Asp His Ala Leu Gln Met Asn Lys Phe Glu Val Glu
 595 600 605

Lys Asp Thr Ile Gly Asp Ile Ile Ile Leu Pro Arg Glu Gln Ala Val
 610 615 620

Leu Met Thr Tyr Tyr Arg Asn Asn Ile Ala His Met Leu Val Leu Pro
 625 630 635 640

Ser Leu Met Ala Ala Ile Val Thr Gln His Arg His Ile Ser Arg Asp
 645 650 655

Val Leu Met Glu His Val Asn Val Leu Tyr Pro Met Leu Lys Ala Glu
 660 665 670

Leu Phe Leu Arg Trp Asp Arg Asp Glu Leu Pro Asp Val Ile Asp Ala
 675 680 685

Leu Ala Asn Glu Met Gln Arg Gln Gly Leu Ile Thr Leu Gln Asp Asp
 690 695 700

Glu Leu His Ile Asn Pro Ala His Ser Arg Thr Leu Gln Leu Leu Ala
 705 710 715 720

Ala Gly Ala Arg Glu Thr Leu Gln Arg Tyr Ala Ile Thr Phe Trp Leu
 725 730 735

Leu Ser Ala Asn Pro Ser Ile Asn Arg Gly Thr Leu Glu Lys Glu Ser
 740 745 750

Arg Thr Val Ala Gln Arg Leu Ser Val Leu His Gly Ile Asn Ala Pro
 755 760 765

Glu Phe Phe Asp Lys Ala Val Phe Ser Ser Leu Val Leu Thr Leu Arg
 770 775 780

Asp Glu Gly Tyr Ile Ser Asp Ser Gly Asp Ala Glu Pro Ala Glu Thr
 785 790 795 800

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Met Lys Val Tyr Gln Leu Leu Ala Glu Leu Ile Thr Ser Asp Val Arg
805 810 815

Leu Thr Ile Glu Ser Ala Lys Gln Lys Glu Gly
820 825